DEPARTMENT OF NOTES, REVIEWS, ETC.

It is the purpose, in this department, to present from time to time brief original notes, both of methods of work and of results, by members of the Society. All members are invited to submit such items. In the absence of these there will be given a few brief abstracts of recent work of more general interest to students and teachers. There will be no attempt to make these abstracts exhaustive. They will illustrate progress without attempting to define it, and will thus give to the teacher current illustrations, and to the isolated student suggestions of suitable fields of investigation.—[Editor.]

ON THE ONTOGENY OF CERTAIN INTERESTING INSECT STRUCTURES.

The young student of microscopy who studies carefully the chitinous structures of various Arthropoda will find many most interesting and peculiar formations. These are well worth an effort to understand.

Chitin, in a state of purity, is a white amorphous substance, and is excreted by the cells of the epidermis. It is secreted in a semifluid form and hardens rapidly on exposure to the air. Chemically, it is supposed to be expressed by the formula $C_{17}H_{14}NO_{12}$. The chitin is manufactured in the cytoplasm of the cell, probably by specialized plastids analogous to the chloroplasts of plants.

In most cases it is produced in rows or strands of small particles, which are extruded thru the wall of the cell; and upon hardening it forms an encasing mold of the surface on which it hardens.

The extrusion of these cell products in vesicular shaped cell membranes forms the various kinds of scales found on insects,—the strings of particles forming the striations which give these scales their refractive properties.

Thus a single cell may produce branched or plumed scales, or spines of various shapes; and even spines or scales with a sensory function. In this latter instance the cell retains its living contents during adult life.

The cross-section of the chitinous foot-pad on the foot of a grasshopper, as shown in Fig. 1 (Plate V), furnishes us with a very

complex series of ontogenetic changes in the cells of the chitin organ.

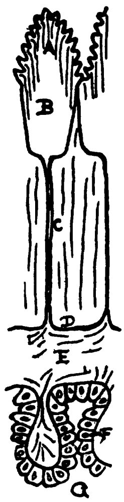

Fig. 2. Diagrammatic sketch of one of the units in the chitinous pad of the grasshopper's foot. The letters correspond in significance with those of Fig. 1.

Originally the cells of the hypodermis (epidermis) were situated on the exterior, as at the point marked A. They were then true epidermis spine cells, each cell being an irregular hexagon and having for its sagitlal outline the form of a short spine with a toothed margin.

The chitin-organ cells (F) then began their excretion of chitin which gradually hardened on exposure to the air. This stage was continued until the section marked B was completed,—the spine cells still being hexagonal, with an opening at each corner of the hexagon.

At the end of the period in which B is formed, a radical change occurs: the six channels at the points of the hexagonal cells now coalesce into a single channel (C) which persists thru a long period of secretion, until the point marked D is reached. At this time another radical change in the process takes place. The secreting cells (F) become entirely detached from the chitinous pad (A-B-C-D), and form a convoluted gland surface which pours its secretion into the space which is formed at E.

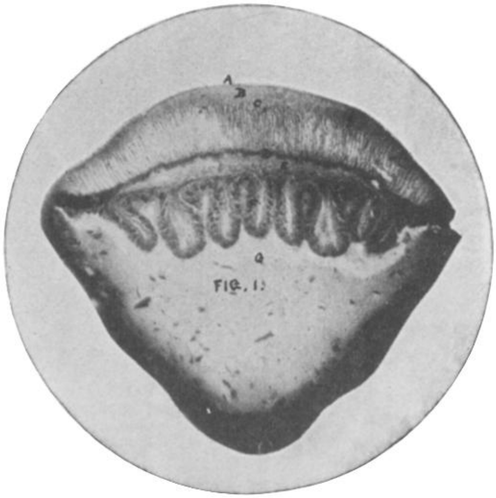

Fig. 1. Photograph of the footpad of the grasshopper.

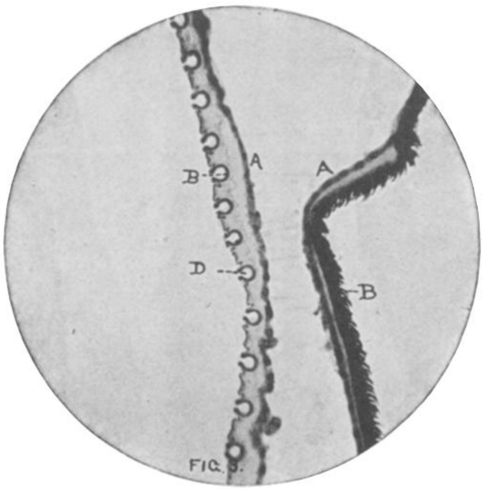

Fig. 3. Photograph of a section of the tongue of Horse-fly, showing the pseudo-tracheal grooves.

Plate V

It is presumed that during life the channels (E) remain open, and convey gland products from E to the exterior thru the hexagonal interstices.

The adhesive organ on the pulvillus of a fly's foot is similar in origin to this pad of the grasshopper, with the exception that the serrations on the original epidermal cells (A) are prolonged in minute hairs, many to the cell,—which hairs have a small cup on the end into which the adhesive fluid is exuded.

The pulvillus of the fly's foot is homologous with the foot-pad of the grasshopper,—only in the fly the pad has become pendant and has moved outward until it lies side by side with the terminal pair of pads, which have been metamorphosed into claws for grasping purposes.

The pseudo-tracheal tubes from the tongue of the horse-fly (Tabanidæ), shown in Fig. 3 (Plate II), are another very complicated form of chitin cell formation. They represent both phylogenetic and ontogenetic changes.

The appendages of the insect head are now quite generally considered to be metamorphosed legs, of which each segment of the body originally bore a pair. Under this description and with this homology, would be included the so-called "tongue" of insects.

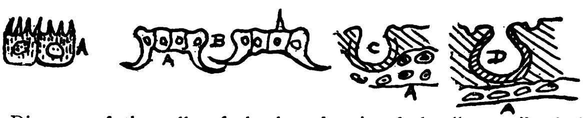

Fig. 4. Diagram of the cells of the hypodermis of the "tongue" of the Horse-fly, suggesting the ontogenetic origin of the pseudo-trachea.

The two legs from which the tongue is formed were evidently covered with a hypodermal layer of cells, each cell of which bears several spines, much perhaps as on the other side of the leg (at A. Fig. 3).

At first the hypodermal layer of cells is flat, with cells of many spines, as at A, Fig. 4. Later it forms a series of parallel invaginations or furrows into which are turned the spines with their bases projecting outward,—which bases form the peculiar shoulder at the edge of the furrow. These spines lie in the furrow alternately, as at B, Fig. 4, first from one side of the furrow and then from the other.

As the chitin deposit thickens, the hypodermal gland cells come to lie more and more removed from their original position and form, as at C, Fig. 4, until finally when the structure is finished, as in D, there is no further connection between the cells and their finished skeletal product.

These false tracheal tubes serve for sucking fluids up into a central channel formed between the pair of legs which conveys fluid to the mouth. This lobe of the tongue seems homologous with the foot-pads on the other legs and is probably a compound of several pads, very much modified in function.

In many kinds of flies the space between the furrows is covered with spines, many of which are sensory in function. In some flies the furrows appear to be closed tubes, which bear a striking appearance and much resemble true tracheal tubes. It is only by knowing the ontogeny of these structures that one can judge correctly of their nature.

The microtome work, on which these photographs and studies are based, was done by the late Dr. G. S. Shanks.

E. W. ROBERTS, *Battle Creek, Mich.*

AN IMPROVED REAGENT STAND.

All users of Bausch & Lomb's reagent stand No. 16342 have no doubt found it one of the best devices for the purpose to be obtained. Some of them, like the writer, may have seen times when it would have been an improvement if the reagent bottles were on a revolving base so that by a slight touch the desired bottle could be brought nearest the operator.

The writer obtained the above result so easily and at such small expense that the following cut and description of the modified reagent stand is submitted, hoping it may prove of interest to others.

Referring to the following cut showing a cross section of the stand: The base, in order to reduce the weight, was recessed 5⅛ inches diameter to a depth ½ inch below the bottom of the recess which received the bell-glass cover.

In order to get the revolving feature, an ordinary ball bearing furniture caster was used by removing the truck and securing the